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Organic matter stability in calcareous soils under different land uses: a density fractionation approach

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The reservoir of soil carbon has been proposed as both a significant source and sink of atmospheric CO_2. Because of this, the capacity of soils to accumulate and stabilize organic carbon has received great attention in recent years. Soil C long-term storage in ecosystems is determined by the balance between the incorporation rate and the decomposition rate of SOM. An improved understanding of these fluxes is vital if we want to increase our awareness of how land use and management affects soil fertility and C sequestration. SOM is heterogeneous and it is possible to distinguish OM pools which vary in their stability and therefore in their intrinsic decay rates. There are three main mechanisms of SOM stabilization: 1) chemical stabilization; 2) physical protection by aggregates; and 3) biochemical stabilization by physicochemical binding between SOM and soil minerals.

This study, carried out on calcareous moor at the region of Castilla y León (Northwestern Spain), focuses the attention on how SOM pools sizes and their total C and N content depend on the position in the soil profile and on the land use management. To this end, we studied soil of 16 profiles under different land use managements: native *Quercus ilex* forest, cereal crop, and *Pinus halepensis* plantation. Density separation in combination with ultrasonic dispersion was carried out in order to obtain SOM fractions with different stabilization stages. Three fractions of SOM were obtained: 1) free particulate OM (FPF), using solution of NaI of 1.6 g cm^{-3} and slight hand agitation; 2) OM occluded within aggregates (OF), using solution of NaI of 1.6 g cm^{-3} and ultrasonic dispersion; 3) organo-mineral fraction (OMF), considered as the remaining material (density $>$1.6 g cm^{-3}). The obtained fractions were analyzed

for total C and N content. A previous laboratory study on soil microbial activity and its modelling was carried out in the same plots. This study allows to analyze the relationship between soil fractions sizes and the kinetic parameters calculated according to the model: potentially mineralizable C (C_o), mineralization rate (k), and the initial potential mineralization rate (kC_o).